WWBTF Mtg.
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City of Alexandria, Virginia

MEMORANDUM

DATE: MAY 15, 2002

TO: THE HONORABLE MAYOR AND MEMBERS OF CITY COUNCIL

THROUGH: PHILIP SUNDERLAND, CITY MANAGER PS

FROM: RICHARD J. BAIER, P.E., DIRECTOR
TRANSPORTATION & ENVIRONMENTAL SERVICES

SUBJECT: WOODROW WILSON BRIDGE PROJECT
NOISE ABATING PAVEMENT

The attached letter reports VDOT experience and conclusions regarding the various options for reducing the noise generated by motor vehicle tires on pavement. Generally, the basic concern regarding these pavement finishes is that they will be skid resistant, durable and economical, as well as reducing the noise generated by tire contact. VDOT has concluded that Stone Matrix Asphalt (SMA) meets basic requirements for flexible pavements constructed on an earth subgrade. For bridge decks, VDOT has found that Random Transverse Tining (grooving) provides a surface that reduces unpleasant harmonic noise. VDOT has agreed to the use of these two types of pavement, as applicable, to minimize highway noise on the Virginia segments of the Woodrow Wilson Bridge Project.

City staff will continue to work with the Project engineers to insure that the optimum balance of noise abatement and serviceability is achieved. Our independent research indicates that the noise reducing qualities, as well as the durability and skid-resistance of SMA pavements are sensitive to the aggregate gradation and mix design of the asphalt paving mixture. We have learned that Longitudinal Tining may be more effective than Random Transverse Tining for noise reduction from concrete pavements. Also, we will discuss concrete finishing options for the Virginia portion of the Woodrow Wilson Bridge with the Maryland State Highway Administration.

cc: Michele Evans, Assistant City Manager
Emily Baker, City Engineer
Reed Winslow, T&ES, Engineering Division, Civil Engineer

COMMONWEALTH of VIRGINIA

PHILIP SHUCET
COMMISSIONER

DEPARTMENT OF TRANSPORTATION
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April 16, 2002
REVISED

Mr. Richard J. Baier, P.E.
Director, Transportation and Environmental Services
City of Alexandria
301 King Street
City Hall, Room 4100
Alexandria, Virginia 22314

RE: Woodrow Wilson Bridge Project
Noise Reducing Pavements

Dear Mr. Baier:

In response to requests from the Alexandria City Council (City Council) and Woodrow Wilson Bridge Neighborhood Task Force (NTF), I have researched the feasibility of utilizing noise reducing pavement designs on the Woodrow Wilson Bridge Project (WWB). In the development of this response, I have coordinated with the following offices within VDOT:

- Virginia Research Council, University of Virginia
- State Materials Engineer, VDOT Central Office
- Environmental Programs, VDOT Central Office
- District Materials Engineer, NOVA District

The City Council requested VDOT to re-consider the Project's previously stated position that the use of "Rubberized Pavement" was not feasible due to concerns on additional maintenance cost. The NTF requested VDOT consider the use of "Whisper Concrete" in order to reduce noise at the tire/pavement interface. My research has determined that although noise reducing pavement designs should not be considered for noise abatement credits in accordance with the VDOT's State Noise Abatement Policy, the application of these pavement designs for the WWB does provide some noise reduction opportunities.

My research considered both Flexible (asphalt) and Rigid (concrete) pavement design options. I offer the following pavement design considerations and recommendations:

Asphalt Pavement Designs:

1. **Rubberized Pavement** (Crumb rubber is added in percentages of 5 to 20% to an asphalt binder and aggregate) - VDOT's experience in including rubber in the asphalt binder of flexible pavements extends back to the early 1990's when several projects were advanced under the guidance of the Virginia Research Council due to a pending federal mandate on the use of rubber, that was later rescinded. The primary consideration under investigation at that time was the use of rubber in our asphalt overlays to address reflective cracking.

   General consensus is that including rubber in the asphalt binder will offer little in noise reduction due to interaction between a pavement surface and tires, since the noise is a function of vehicular speed and the texture of the roadway. Rubber mixes are normally very dense and would thus, offer little towards noise reduction versus an open or gap graded asphalt mix design. Research is currently developing both in Europe and in other states to consider these types of open graded mix designs, but thus far no conclusions on noise reduction are available.

   VDOT's experience in using "rubberized pavements" has not been very positive, and while it may still be considered for certain short-term maintenance applications, use on the WWB as a noise-reducing pavement would be experimental at best. Given the lack of conclusive evidence on noise reduction, little evidence of long-term durability, and the obvious premium cost to produce this experimental asphalt mix design, I cannot support its use on the WWB project for a noise reducing pavement section.

2. **Open Graded Friction Course** (A very fine layer of aggregate that is spread over the surface of the hot mix asphalt) – The friction course reduces tire spray in wet weather and noise in dry weather due to the texture created by the aggregate layer. It has been viewed as an effective noise-reducing pavement in high-speed applications.

   VDOT has experienced durability problems with this design in urban areas where traffic congestion results in more frequent stops and starts by vehicles, especially heavy trucks or buses. There is also a concern with snow/ice control, as well as loss of skid resistance over time. Based on previous history for repeated maintenance, I would not recommend this pavement design for use on the WWB project for a noise reduction pavement section.

3. **Stone Matrix Asphalt, or SMA** (A coarse aggregate asphalt mix design that provides texture to the pavement surface) - Although the course surface texture may be deemed aesthetically unattractive, it is ideal for high volume areas such as the WWB. This pavement design has been used in NOVA District with marginal success over existing pavements due to the permeability of the courser aggregate. VDOT has recently implemented a less permeable specification and obtained measurable success in the Richmond area.

   While snow and ice control will require heavier applications of de-icing chemicals, there is less concern on loss of skid resistance than with a friction course design. The course aggregate will hold up better under the urban traffic conditions, although there is still a concern for rutting. I recommend we proceed with developing finer SMA mix design for use as a noise-reducing pavement on the WWB projects.

Concrete Pavement Design and Bridge Decks

1. **Whisper Concrete** (A course aggregate concrete overlay that provides texture to the concrete pavement)- The overlay has shown to be effective in the United Kingdom for noise reduction. In the United States, it has been plagued with problems of de-bonding of the overlay from the concrete substrate, mostly due to poor workmanship during initial construction. In addition, typical good concrete overlays display a service life of only 15 to 20 years in an urban environment as compared with the 50-year design life for a bridge deck.

   Reports are that the technology is sound, in that the texture of the concrete pavement or deck surface provides for noise reduction. However, concerns have arisen in the United States regarding degradation of pavement friction over time (resulting in poorer braking performance by vehicles), as well as snow and ice control. This design may be considered for low volume applications on smaller bridges as a noise reducing pavement.

2. **Random Transverse Tining** (Random or irregular transverse grooving of the concrete pavement or deck surface to reduce the harmonic noise produced during the tire rigid pavement interactions) - Many states have adopted this method to reduce noise impacts on concrete pavements and bridge decks. Grooves are normally placed on concrete pavements/decks for safety considerations (i.e. skid resistance). By varying the spacing in the groove pattern, studies show that external noise emanating from the tire/pavement interaction is reduced.

   VDOT standards require grooving (e.g. ¾" spaced 1/8" sawed grooves at 1/4" deep) of its concrete pavements and bridge decks for skid resistance. There will be minimal additional cost or concerns in regard to long-term maintenance if the grooves were randomly spaced. I recommend that Random Transverse Tining be implemented as a noise reducing measure on all WWB bridge decks and concrete pavement surfaces.

In accordance with the recommendations noted above, I am proceeding to include these measures in an effort to reduce the external noise from one of the noise generating sources of the proposed WWB improvements (i.e. the source noise from tire/pavement interaction). Should you have any concerns or require additional information in this regard, please feel free to contact me.

Sincerely,

Ronaldo T. Nicholson, P.E.
Project Manager
Woodrow Wilson Bridge Project

cc: F. Gee, M. Kerley, A. Mergenmeier, L. Lundy, A. Anday, D. Shiells- VDOT
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